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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,671	12/21/2001	Daniel T. Colbert	11321-P011C1D2	1673

7590 12/08/2003

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EXAMINER

LISH, PETER J

ART UNIT	PAPER NUMBER
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1754

DATE MAILED: 12/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/027,671

Applicant(s)

COLBERT ET AL.

Examiner

Peter J Lish

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 22 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 84-140 is/are pending in the application.
- 4a) Of the above claim(s) 104-108 and 114-140 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 84-103 and 109-113 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5,7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election without traverse of Group I, claims 84-103 and 109-113 in Paper No. 9 is acknowledged. Claims 104-108 and 114-140 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 84-90, 92-94, and 97-103 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kiang et al. ("Structural Modification of Single-Layer Carbon Nanotubes...").

Kiang et al. teach that single-walled nanotubes tend to stick together in parallel bundles, which are woven together to give a carbon net, or mat, giving rise to a soot with a rubbery texture. Kiang et al. teaches the sonication of these samples in ethanol and the depositing of the suspension onto a grid.

Regarding claims 84-90, and 92-94, it is not explicitly taught that the nanotubes are cut and untangled, however, it is expected that this occur because no difference is seen between the process of Kiang et al. and that of the instantly claimed invention. Additionally, Kiang does not

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explicitly teach the lengths of the carbon nanotubes after sonication treatment. However, it is expected that at least some of the nanotubes have lengths within the claimed range, as no difference is seen between the process of Kiang et al. and that of the instantly claimed invention.

Where, as here, the reference discloses all the limitations of a claim except a property or function, and the examiner cannot determine whether or not the reference inherently possesses properties which anticipate or render obvious the claimed invention, the burden of proof is shifted to the applicant, as in *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980).

Regarding claims 97-99, Kiang teaches the process of electron beam irradiation. Kiang teaches that under intense electron beam heating, the nanotubes are broken, or cut. Occasionally, the tubes were fragmented, or cut, into sections. Note that claim 99 does not require the reflux of the nanotubes in concentrated nitric acid because claim 98, to which it depends, does not require the step of reflux. Regarding claims 100-103, Kiang teaches that single-walled nanotubes have defects in the graphene sheet structure that allow the tubes to bend, buckle, and distort. These defects occur when the tubes are tangled with each other, such as is the case of the produced nanotube samples. Additionally, defects, such as small ripples in the walls, are created by electron beam irradiation. While it is not explicitly taught that the sonication may additionally cause defects, it is expected that this be the case, due to the forces that act upon the nanotubes during the sonication process.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 84-86, 89-90, 92-94, and 96 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Heer et al. ("Aligned Carbon Nanotube Films...") taken with Seraphin et al. (Single-walled carbon nanotubes...").

De Heer et al. teach a process for the production of thin films of aligned carbon nanotubes, comprising ultrasonically dispersing, or sonicating, nanotube samples in ethanol and drawing the suspension through a filter. De Heer does not explicitly teach the use of single-walled nanotubes.

Seraphin et al. teach the production of tangled threads, or ropes, consisting of bundles of 5-15 single-walled nanotubes. It would have been obvious to one of ordinary skill at the time of invention to perform the process of de Heer et al. on the nanotube samples of Seraphin et al. in order to form thin films of aligned carbon nanotubes.

It is not explicitly taught that the nanotubes are cut and untangled, however, it is expected that this occur because no difference is seen between the process of de Heer et al. and that of the instantly claimed invention.

Claims 84-86, 89, 91-93, 96-99, and 109-113 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiura et al. (US 5,698,175) taken with Seraphin et al.

Hiura teaches a process for the purification and uncapping of carbon nanotubes, comprising treating the nanotube sample with an aqueous solution including a reaction reagent,

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for example nitric acid. The process comprises dispersing the nanotubes with ultrasonic into the reaction solution and refluxing at a temperature of 120-180 °C to provide oxidative etching. The nanotubes are then filtered for recovery. Hiura does not explicitly teach the use of single-walled nanotubes.

Seraphin et al. teach the production of tangled threads, or ropes, consisting of bundles of 5-15 single-walled nanotubes. It would have been obvious to one of ordinary skill at the time of invention to perform the process of Hiura et al. on the nanotube samples of Seraphin et al. in order to purify and uncap the carbon nanotubes.

Regarding claims 84-86, 89, 91-93, and 96-99 It is not explicitly taught that the nanotubes are cut and untangled, however, it is expected that this occur because no difference is seen between the process of de Heer et al. and that of the instantly claimed invention.

Claim 95 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kiang et al. as applied to claims 84 and 93-94 above, and further in view of Howard et al. (US 5,985,232).

Kiang teaches the sonication of the nanotube soot samples in ethanol, with the deposition of drops on a carbon grid for analysis. Howard teaches the production of soot containing nanotubes, including single-walled nanotubes, in a burner chamber. The soot is dispersed by sonication in an organic solvent, such as toluene, and drops of the suspension are placed on a carbon grid for analysis. It would have been obvious to one of ordinary skill at the time of invention to substitute toluene, as taught by Howard et al., for the ethanol of Kiang et al., as it is seen to have an equivalent effect.

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Additionally, Howard teaches the process of soxhlet extraction to extract fullerene structures. Official notice is taken that soxhlet extraction uses organic solvents, such as benzene, toluene, or xylene. It would have been obvious to one of ordinary skill at the time of invention to perform soxhlet extraction, as taught by Howard et al., on the nanotube samples of Kiang et al., in order to extract various fullerene structures.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772 until December 11<sup>th</sup> and 571-272-1354 thereafter. The examiner can normally be reached on 9:00-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached at 703-308-3837 until December 11<sup>th</sup> and 571-272-1358 thereafter. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



PL

STUART L. HENDRICKSON  
PRIMARY EXAMINER